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Obesity Phytotherapy: Review of Native Herbs Used in Traditional Medicine for Obesity

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Abstract

Obesity is an important disorders due to which 25 million deaths occur annually worldwide. Synthetic drugs for weight loss have low efficacy and high side effects. Apart from synthetic drugs in modern medicine, various other methods including the use of herbal medications are used to induce weight loss. Cambodia hoodia, green tea, *Citrus aurantium*, white beans, fenugreek, caffeine, ephedrine, capsaicin, yohimbine, chitosan, fitostreols, and guar gum have been studied in clinical trials and their effects have been confirmed. It seems necessary to study more to determine the effectiveness and safety of medicinal plants and herbal extracts as well as pharmaceutically active ingredients that may have the property of weight loss. In this article, we aimed to review recent knowledge about medicinal plants that are recommended for weight loss.

Keywords

obesity, medicinal plants, Iran

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Obesity is a common nutritional disorder that has been rapidly increasing in the past 2 decades. By definition, obesity is a condition in which the amount of body fat increases quickly. Assessment of obesity is measured and reported by body mass index.[1]

According to published reports, 25 million people die annually due to overweight and obesity worldwide.[2] Based on epidemiologic studies, body mass index is used to describe overweight and obesity.[3] There is a relationship between lifestyle and body mass index, especially in women.[4] Studies show that the impact of lifestyle on obesity in Western countries is 15% to 20%.[5]

Body mass index is defined as weight in kilograms divided by the square of the height in centimeters. Body mass index of 18.5 to 24.9 is normal, less than 18.5 low weight, and values of 25 and above are considered as obese.[6] The prevalence of obesity in many industrialized countries, especially in the United States, and in developing countries is growing; studies show that about 64% of American adults are overweight and almost 33% of them are obese.[7,8] In this article, we aimed to review recent knowledge about medicinal plants that are recommended for weight loss.

Pathophysiology of Obesity

The pathophysiology of obesity and overweight in life is quite complex and involves the interaction of various factors including genetic, metabolic, environmental, and behavioral variables.[9]

The total amount of energy needs decreases with increasing age. Resting metabolic rate, lean body mass, physical activity, and thermal effect of food decrease with increasing age.[10]

The redistribution of body fat also increases with age, which leads to increased visceral fat and decreases subcutaneous fat. On the other hand, the level of hormones and cytokines is altered, leading to the formation of adipose tissue throughout life.[11] These changes include decreased testosterone and growth hormone levels and reduced responsiveness to leptin and thyroid hormone. Decreased testosterone and growth hormone levels increase fat mass and reduce lean mass.[11] Oxidative metabolism decreases in aging. On the other hand, loss of response to leptin may cause a feeling of fullness in insufficient eating.[11]

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Table 1. The Plant Name, Scientific Name, and the Effects and Effective Doses for the Treatment of Obesity and Weight Gain.

Number	The Scientific Name	Clinical Trial Results
1	*Garcinia cambogia*	*Garcinia cambogia* is a plant that grows in Southeast Asia and its fruit have been used in a few studies to induce weight loss. Hydroxy citric acid, which includes up to 30% of the fruit weight, possibly reduces fat production. The substance is often marketed as an appetite suppressant.[40]
		Results of a clinical trial showed that a daily intake of 2.4 grams *Garcinia* standardized extract (1.2 g hydroxy citric acid) with placebo, with 1200 kcal diet, was administered for 3 months in 89 females and 1.3 kg weight loss was observed.[41]
2	*Hoodia gordonii*	It seems that special matter in *Hoodia* extract called P57 is responsible for appetite suppressant properties.[42]
3		In a study, green tea extract containing 90 mg of green tea catechin gallate and 50 mg of caffeine, called epithelial epigallo catechin gallat; a capsule containing 50 mg of caffeine alone; or placebo were given to 10 healthy male subjects. Average annual energy consumption of the drug in patients who have been given the green tea extract was 6754 kcal and for those who received caffeine it was 6745 kcal, and it was only 6463 kcal to those given placebo.[43]
		It is believed that tea catechins are polyphenolic components that act by inhibiting damage of norepinephrine, which causes production of heat by tea. The effect of catechin and the simultaneous oxidation of the mitochondrial ATP production increases and decreases and thereby generates heat and causes weight loss.[44,45]
		Other mechanisms of green tea catechins in the treatment of obesity that may inhibit the development of blood vessels and adipose tissue.[46]
4		*Citrus aurantium* contains alkaloids such as sinefrin and oktopamine that act as symptomatic agonists, directly or indirectly. The materials with very low concentrations of parts per million of water and orange blossom are known to induce weight loss. There are claims that in this mechanism ephedra alkaloids act in a similar manner but are weaker.[47,48]
		Weight losses arising from the use of 2.05 to 3.1 kg have been reported in clinical studies.[49-51]
5	*Irvingia gabonensis*	Result of a randomized, double-blind, placebo-controlled study showed no significant difference between the groups treated with *Irvingia gabonensis* 1.05 g 3 times a day for a month with respect to weight loss, total cholesterol, low-density lipoprotein cholesterol, and triglycerides; and increases in blood high-density lipoprotein cholesterol and decreases in waist circumference and hip circumference were reported.[52]
6	*Phaseolus vulgaris*	Results of a clinical trial showed that a daily intake of 445 mg tablets of white bean extract for 30 days in patients aged 20 to 45 years showed little increase in weight (body weight, body mass index, fat mass, adipose tissue thickness, and waist and buttocks and groin) and will be significantly reduced compared with the placebo group, whereas lean body mass did not change compared with placebo.[53]
7	*Trigonella foenum-graecum* L	Results of a randomized trial study of 39 healthy overweight men showed that daily consumption of 1176 mg placebo for 6 weeks of fenugreek seed extract, the amount of fat eaten daily, and the ratio of the amount of energy intake by the amount of fat eaten to the amount of the total energy consumption is in the expression of most people to whom the fenugreek seed extract was given compared with the placebo group significantly declined. Also significant decrease was noted compared with fasting and postprandial blood glucose and insulin in the fenugreek seed extract group compared with the placebo group.[54]

Herbs always have been a rich source of effective drugs against diseases such as infectious and parasitic diseases,[12-23] diabetes,[24] hypertension,[25] hyperlipidemia,[26] digestive diseases,[27] respiratory diseases,[28] neurological and psychiatric disorders,[29,30] pain,[31,32] headaches and migraines,[33] cold,[34] wounds and skin problems,[35] stomach problems,[36] dysmenorrhea,[37] disorders of the reproductive system,[38] and so on.

Obesity Treatment With Chemical Agents

There are some medications for the treatment of obesity and overweight including orlistat and sibutramine. In addition to high cost, these drugs have side effects and have limited efficacy in the treatment of obesity.

Complementary Treatment of Obesity

Complementary and alternative treatments for weight loss include medicinal plants and their active ingredients, acupuncture, homeopathy, and sleep therapy, which have existed since ancient times.[39]

Lists of medicinal plants that may help in reducing obesity and overweight are presented in Tables 1 to 4.

Discussion and Conclusion

Obesity is one of the most prevalent condition that affects all age groups. Obesity can lead to many complications including type 2 diabetes mellitus, heart disease, and stroke. There are some synthetic drugs that are used for the control of obesity; however, the safety and efficacy of these drugs are under question.[64-66] Some medicinal plants have recently been examined for the treatment and management of obesity. Studies with *Camellia sinensis*, *Crocus sativus* L, *Nigella sativa*, seaweed laminaria, green tea, Xantigen, Oolong tea, *Irvingia gabonensi*, sea buckthorn, and bilberries have been conducted, and especially *Nigella sativa*, *Camellia sinensis*, and green tea have shown satisfactory antiobesity properties. It should be noted

Table 2. Name of Compound or Active Ingredient and Mechanism of the Influence of the Treatment of Obesity and Weight Gain.

Number	The Compound or Active Ingredient	The Plant Name	Mechanism and the Influence
1	Caffeine and ephedrine	Ma huang	A combination of caffeine and ephedrine reveal thermal properties, which increases energy and reduces weight.[55]
		Guarana	A combination of caffeine and ephedrine dose of 200 mg of caffeine and 20 mg of ephedrine caused weight losing in 3 days.[56]
			A study of placebo-controlled, randomized, double-blind, 8-week study on 67 overweight adults with a body mass index of 29-35 indicated that the combination of weight and Ma huang–Guarana, 240 mg/dL and 72 mg, the weight of the study adults reduced 4 kg compared with placebo, which significantly reduced 8 kg. Percent body fat, and waist and hip circumference, and serum triglyceride concentrations were significantly higher in the active treatment group.[56]
2	Capsaicin	Chili pepper	Capsaicin from chili pepper and red (chili and red peppers) with the mechanism of fat oxidation and heat will cause weight loss. It seems that the primary mechanism of active ingredients of chili is active nerve signals of vasodilators and releasing endorphins. There are also reports that the weight of people who regularly use chili peppers is slightly reduced.[57,58]
3	Yohimbine	*Pausinystalia johimbe*	Yohimbine, the active ingredient of *Pausinystalia johimbe*, is an α-2 receptor antagonist. In a clinical study, yohimbine with a dose of 20 mg daily for 3 weeks reduced weight significantly compared with the placebo.[59]
4	Phytosterols		Phytosterols (in animal studies) inhibit fat absorption and cause weight loss; however, currently no data on the effect of weight loss due to phytosterols in humans have been reported.[60]
5	Chitosan		The results of a human clinical trial showed that in chitosan and placebo groups, which were double-blind, 3 g of chitosan or a placebo daily for 60 days were consumed with their food according to a handbook about behavior change; those with chitosan received 2.2 kg and 3.6 kg more than the control group than in the placebo group lost weight.[61]
6	Guar gum	*Cyamopsis tetragonolobus*	Guar gum extracted from the plant *Cyamopsis tetragonolobus* regarding effectiveness for weight loss by performing a meta-analysis of 20 studies, 11 studies evaluated were ineffective and 9 studies have had little effect.[62]
7	Glucomannan	*Amorphophallus konjac*	The glucomannan is the fiber, water extracted from the root of Amorphophallus konjac. Effect of glucomannan in a double-blind, randomized clinical trial involving patients with a weight of 20% or more of the desired weight was studied. The results showed significantly greater weight loss in the treatment group compared with placebo. No adverse effects were observed in the treatment group.[63]

Table 3. Name of Herbal Remedies and Weight Loss Mechanism in Accordance With the Recommendation of Food and Drug Administration (FDA).

Number	Herbal Drug Name	Brand	The mechanism of action
1	Diethylpropion	Tenuate	Appetite suppressants and the mechanism of symptomatic
2	Phentermine	Generic, Adipex-P, Fastin, Lonamin	Appetite suppressants and the mechanism of symptomatic
3	Sibutramine	Meridia	Serotonin-norepinephrine reuptake inhibitor by inhibiting appetite
4	Orlistat	Xenical, Alli	Inhibitor of gastrointestinal triacylglycerol lipase

Table 4. Name of Herbal Medicine, the Drug, and Its Active Ingredient in Weight Loss in the Pharmaceutical Market.

Number	Name of Herbal Remedies on the Market	Drug Form	Herb or Its Active Ingredient
1	Carvil	Tablet	Celery, sorrel, anise, cumin
2	Slim Quick	Tablet	Celery, dill, green tea
3	Lime essence	Oral drops	Lime
4	Cumin essence	Oral drops	Cumin
5	Apple cider vinegar	Tablet	Apple
6	Green tea	Tablet	Green tea

that the efficacy of these herbal medicines is still an important point that should be elucidated for interpretation.[64-68] Although there is no important report about the side effects of these plants, the safety of these plants still remains to be evaluated.[64]

The antiobesity mechanisms of most of medicinal plants are not clear. However, decreased pre-adipocyte differentiation and proliferation, increased energy expenditure, reduction in lipid absorption, reduced energy intake, or increased

lipolysis and decreased lipogenesis have been proposed for these plants.[69] Decreased energy intake is caused by green tea and oolong tea by acting on pancreatic lipase. Polyphenols obtained from tea extracts including epigallocatechin, epigallocatechin-3-gallate, L-epicatechin, and epicatechin-3-gallate have shown inhibitory activity against pancreatic lipase, leading to weight loss.[69]

Nigella sativa, *Camellia sinensis*, and oolong tea have shown a significant weight loss effect with reduction in fasting blood sugar, low-density lipoprotein cholesterol, and triglycerides levels. Most of these medicinal plants have anti-hyperlipidemic property, which is effective in the treatment of obesity.[70]

Some herbs and their metabolites such as epigallocatechin-3-gallate of green tea increase metabolic rate and the body fat metabolism and oxidation.[71,72] The herbs such as *Nigella sativa* and green tea are effective in oxidant-related diseases and decrease lipid peroxidation in plasma or liver, which seem to be a mechanism of antiobesity effect. Higher antioxidant plants such as green tea have shown good antiobesity activity.[73]

Oxidative stress has been considered for many diseases including diabetes,[74-76] cancer,[77-79] infection,[80-82] and cardiovascular[83-86] diseases as well as some toxicities.[87-89] Obesity has also been shown to be associated with increased oxidative stress.[90] The suggestion that obesity is a state of chronic oxidative stress increases the importance of developing effective strategies against obesity. Most of the plants presented in this article have antioxidant activity. If this is the case and antioxidant activity of these plants induce antiobesity activity, other plants with antioxidant activity[91-97] might also have antiobesity property, which is worth examining.

Author Contributions

All the authors contributed equally to the writing of this article.

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Ethical Approval

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